ChemiDoc™ XRS+ Imager

Effortless and Accurate Imaging and Analysis for Gels and Blots

BIO-RAD

Solve Complex Biological Questions with Simple and Reliable Imaging

For more than two decades, Molecular Imager® systems from Bio-Rad have been widely recognized and trusted high-quality imaging instruments. Whether your research includes routine imaging of chemiluminescent western blots, SDS-PAGE, or PCR products for diagnostics or therapeutic development — the ChemiDoc XRS+ imaging system will meet your needs. Designed for ease of use and ability to support a wide array of applications, it is a perfect fit for individual laboratories or multiuser core facilities. Quality standards of engineering and manufacturing make the system adaptable to academic or biopharmaceutical laboratories. Thousands of researchers over the years have published images acquired with the ChemiDoc XRS system in journal articles and grant proposals and established a record of reliability and excellence for the system.

The ChemiDoc XRS+ system enables direct digital visualization of chemiluminescent western blots for accurate images of accumulated signal from the chemiluminescent reaction. It provides reliable quantitative data for characterizing your samples reproducibly.

The ChemiDoc XRS+ system is flexible and easy to use and supports other detection methods including fluorescence and colorimetry. It is the ideal complement to your electrophoresis, purification, and PCR systems, enabling image analysis and documentation of western blots, protein and DNA gels, and other sample types.

What the ChemiDoc XRS+ System Can Do for You:

Automated workflow from image to results

- Makes your blot and gel imaging and analysis quick and effortless
- Eliminates the need for training
- Allows any user to repeat the same workflow in exactly the same way

Automated image capture

- Produces beautiful pictures of your blots and gels
- Delivers quantitative analysis of your protein and DNA samples

Automated image optimization

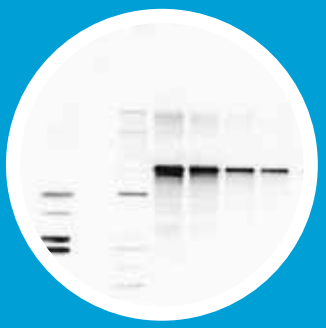
- Delivers image data that is always optimized and reproducible without imaging artifacts
- Eliminates the need to use costly and undependable X-ray film techniques

Automated image analysis

- Produces reports with data organized the way you want
- Minimizes time from lab work to presentations

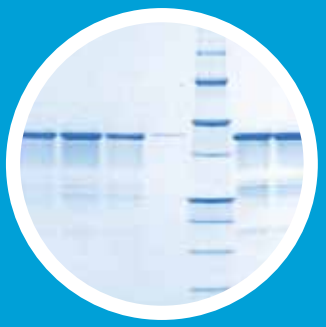
ChemiDoc XRS+ System Applications

Nucleic Acid Electrophoresis	Protein Gel Electrophoresis	Blotting
Ethidium bromide	Coomassie Blue	Chemiluminescent
SYBR® Green	Copper stain	Colorimetric
SYBR® Safe	Zinc stain	Qdots 525
SYBR® Gold	Flamingo™ fluorescent gel stain	Qdots 565
GelGreen	Oriole™ stain	Qdots 625
GelRed	Silver stain	CY2
Fast Blast™ DNA stain	Coomassie Fluor Orange	Alexa Fluor 488
	SYPRO Ruby	DyLight 488
	Krypton	Fluorescein

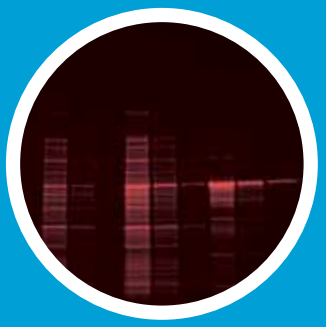


Immun-Star™ WesternC™ chemiluminescent detection

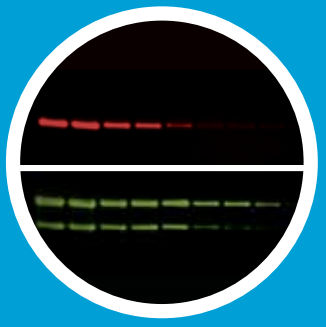
SYBR® Safe stain



Coomassie Brilliant Blue R-250 stain



Oriole™ stain



Qdot blot

ChemiDoc XRS+ System Is Powered with Image Lab™ Software

Fast Results from a Completely Automated Workflow

The ChemiDoc XRS+ system is controlled by Image Lab software to automatically and reproducibly generate blot and gel images. Image Lab software is fast, taking you from blot to printed results in seconds. Your results are visible with a single click of the mouse.

Image Lab software eliminates the guesswork in imaging. You won't have to perform tedious repetitive steps to find the right focus setting. You won't have to guess which exposure times will best visualize the bands of interest. Image calculations and corrections are done automatically for your application. Whether you are working with protein gels, nucleic acid gels, blots, or your own customized imaging application, the ChemiDoc XRS+ system will select the proper settings for optimum detection conditions of the stain, label, or light-emitting substrate in use.

You also won't need to set aside time for training new users; the system and the software are easy to use and work together from setup to finish. Imaging and image analysis can become the simplest work in the laboratory.

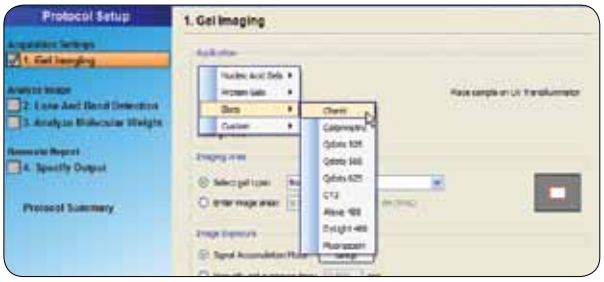
Simple and Reproducible Image Capture

Place your gel or blot on the ChemiDoc XRS+ imager's sample tray and run your protocol: Your work is done in just one step. Design and save protocols for the imaging steps in your experiments and Image Lab software will run the protocols exactly the same way every time. The protocol feature negates variability in results due to different people operating the imaging system. When a new project is related to an existing one, you can reuse the previously created protocol by revising its parameters and renaming it. Image Lab software lets you devote your valuable time to research and discovery instead of to wondering if you used your imaging system properly.

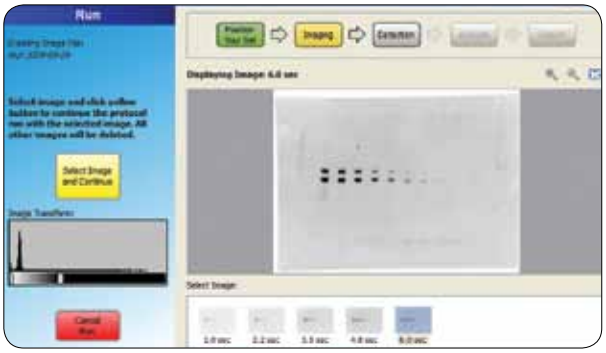
Results and Reports

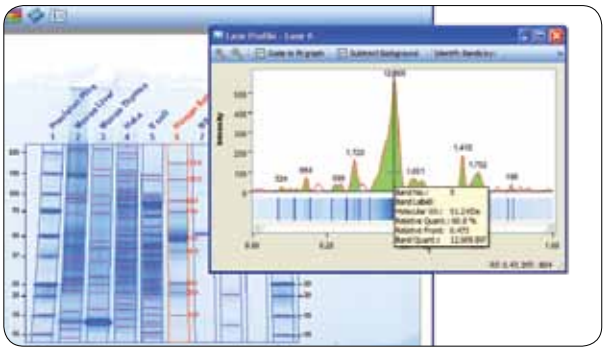
In addition to printing a picture of your gel or blot for your records, Image Lab software creates and prints reports of your experimental data. Any part of the report can be copied into popular document processing applications such as Adobe Acrobat and Microsoft Word, PowerPoint, or Excel files. To include a 3-D view of your gel or blot, copy it using the Snapshot tool, and paste it into your presentation slide. High quality, good-looking reports are easy to produce with the combined power of the ChemiDoc XRS+ system and Image Lab software.

When an analysis parameter is changed, the results tables are updated instantly to reflect the new data.



Automated workflow for any application.

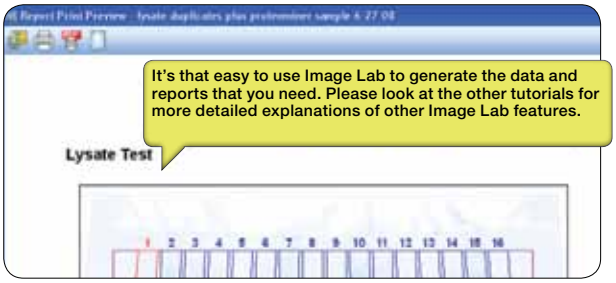




Lane profiles depict band intensity and represent quantities of sample components separated in a gel.

Tutorials

With Image Lab software, you don't need previous imaging experience to produce optimal gel and blot images. Detailed tutorials are accessible via the toolbar and start-up page to acquaint you with all of the Image Lab software capabilities.


It's that easy to use Image Lab to generate the data and reports that you need. Please look at the other tutorials for more detailed explanations of other Image Lab features.
Lysate Test

Tutorials for novice users.

Immunodetection

Sophisticated Software

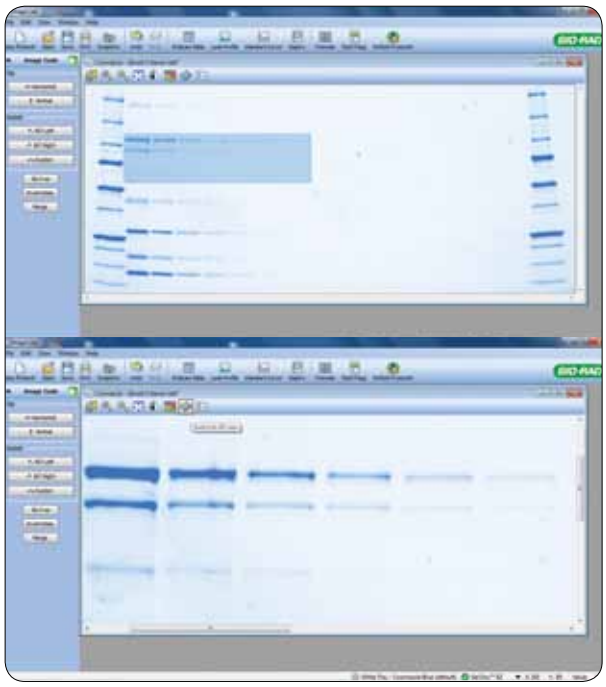
Automated workflows — the entire workflow (image capture, results, report) is recorded in a protocol file. Protocols can be edited, resaved, reused, and shared among multiple users. Allows 100% repeatability of the workflow and ensures optimized image data and analysis specific to the selected application.

Auto focus — Image Lab software's proprietary algorithms calibrate the system at setup for an automatic focused image at any zoom level. Eliminates user error and the need for manual camera adjustments to obtain an image, leading to higher image quality.

Auto camera aperture control — you do not have to focus, nor adjust aperture settings. Only adjust the zoom to position sample. Allows you to quickly image across different applications with different aperture setting requirements.

Flat fielding — flat fielding calibrations are performed for each application automatically. Delivers image data that is always optimized and reproducible without imaging artifacts for superior image uniformity and quantification.

Increased image resolution — decreases pixelation when images are cropped or zoomed. Allows smooth, clean images at any zoom level.



Images can be zoomed in without losing resolution.

Greater export functionality — no need to export images to another program such as Photoshop image editing software to change the dpi before importing for publication. You can now define your desired resolution within Image Lab software.

Chemiluminescent Detection

Use the signal accumulation mode (SAM) of the ChemiDoc XRS+ system to record the time course of development of the chemiluminescent reaction.

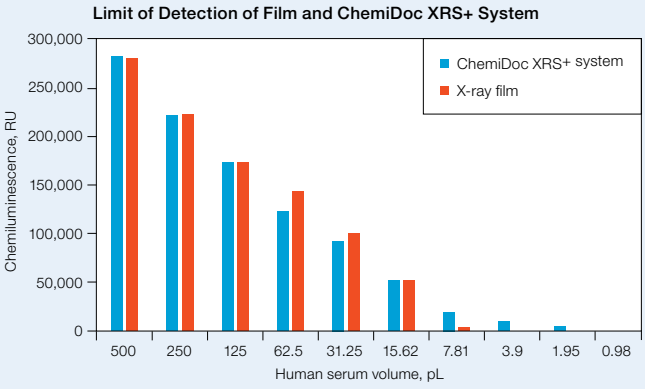
- Eliminate the guesswork often involved with single-event film capture of blot signals
- Simplify chemiluminescent digital imaging

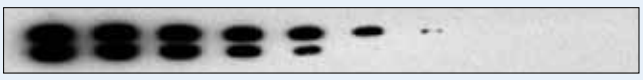
During the live acquisition, the ChemiDoc XRS+ system records progressive image development, allowing you to:

- Visualize the accumulated chemiluminescent signal at multiple time points and capture the image
- Customize acquisition time and the number of images taken
- Save and analyze each image while the next image is being captured, even before the series is complete

Automatic digital capture of chemiluminescent blot signals is efficient.

- Eliminate the chemical use and disposal problems involved with film developing
- The self-contained lighttight enclosure means you don't need a separate darkroom
- For a more detailed comparison of digital detection with the ChemiDoc XRS+ system and analog detection with film, refer to bulletin 5809.





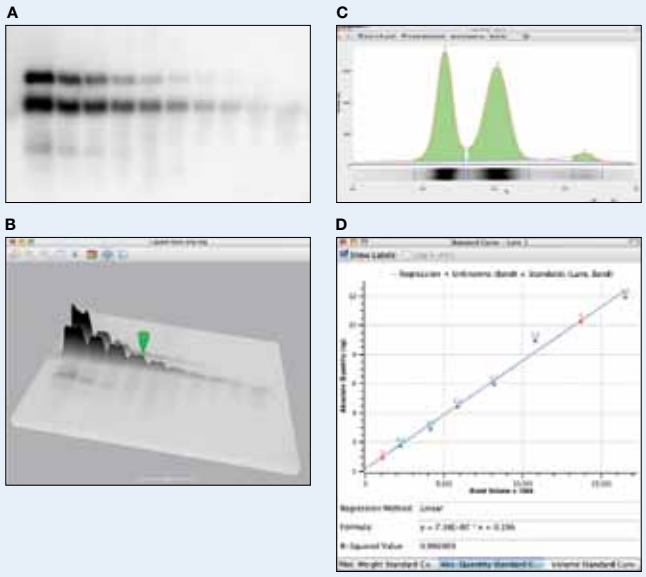
X-ray film (300 sec exposure)

ChemiDoc XRS+ system (60 sec exposure)

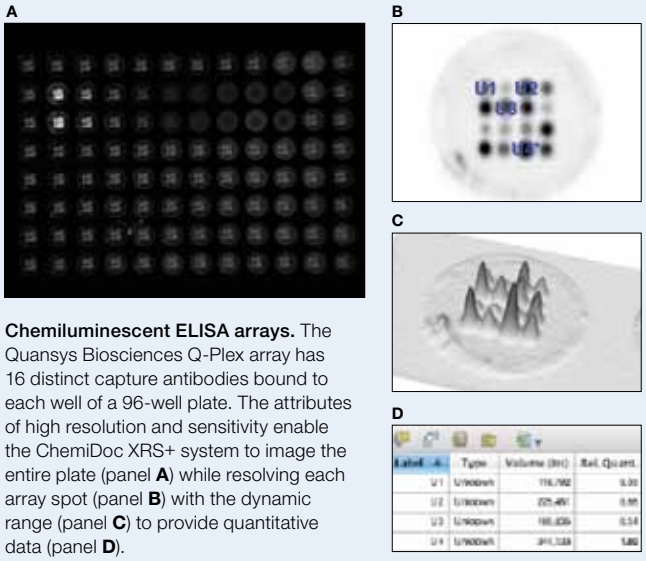
Comparison of chemiluminescent western blot detection on X-ray film and with the ChemiDoc XRS+ system. Blots of twofold serial dilutions of human serum were probed with rabbit anti-human transferrin polyclonal antibodies. A 1/1,000 dilution of human serum was used to make the twofold serial dilutions. A 300 sec exposure on film does not reach the same limit of detection that is reached by a 60 sec exposure in the ChemiDoc XRS+ system.

Accurate Quantitation Visualized

The ChemiDoc XRS+ system can perform accurate quantitative detection with high resolution and sensitivity on a wide variety of samples.

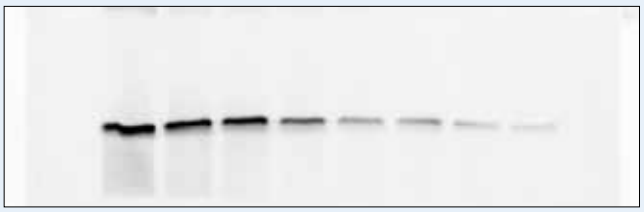


Quantitative dynamic range and visualization tools. A, the ChemiDoc XRS+ system detects a wide range of sample concentrations without saturating the most concentrated band, enabling linear quantitation. A variety of visualization tools are provided for sample verification. **B**, the 3-D viewer shows the distinct peaks of the most concentrated band as well as the faintest band. **C**, the lane profiles provide quick comparison of expression levels from each lane. **D**, the volume regression curve shows a correlation coefficient R^2 of 0.986909 confirming linear data over the entire range of sample detection.

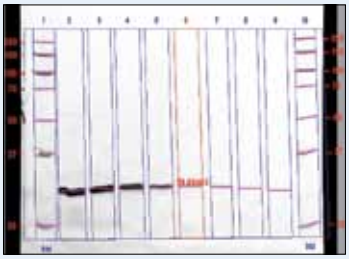


Chemiluminescent ELISA arrays. The Quansys Biosciences Q-Plex array has 16 distinct capture antibodies bound to each well of a 96-well plate. The attributes of high resolution and sensitivity enable the ChemiDoc XRS+ system to image the entire plate (panel **A**) while resolving each array spot (panel **B**) with the dynamic range (panel **C**) to provide quantitative data (panel **D**).

Chemiluminescent and Colorimetric Detection Combined in a Single Blot



Chemiluminescence

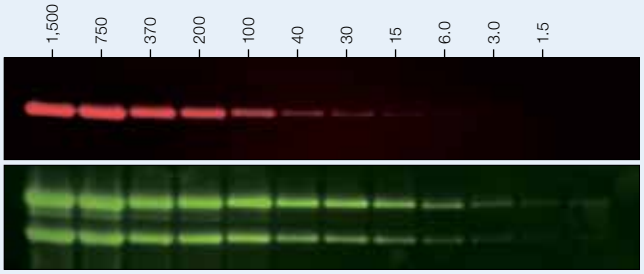


Chemiluminescence image from sample merged with visible marker

Visible marker

Chemiluminescent sample detection and visible markers. Visible markers are commonly used to monitor problems with SDS-PAGE and blot transfer. To determine the molecular weights, users trace the pattern of the visible marker from the blot to film. This adds additional steps and can possibly introduce errors. The ChemiDoc XRS+ system images the chemiluminescent samples and visible markers to provide a digital record; the images are then merged for molecular weight estimation.

Multifluorescent Western Blot

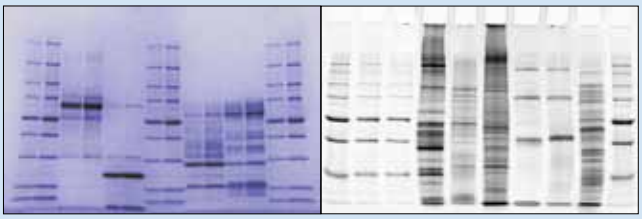


Multifluorescent western blot detection of maltose binding protein (MBP) and Profinity eXact™ fusion-tagged MBP bands using Qdot 625 and Qdot 525 fluorescent conjugated secondary antibodies (Invitrogen Corp.), respectively, imaged with the ChemiDoc XRS+ system. The blot was imaged with excitation via UV, and separate images were taken by switching between 520/30 (Qdot 525) and 630/30 (Qdot 625) filters installed in the ChemiDoc XRS+ imager. Multifluorescent western blotting enables detection of two antibody-specific proteins at once, removing the variability involved with two blots or the loss of protein with stripping. For more information, refer to bulletin 5792.

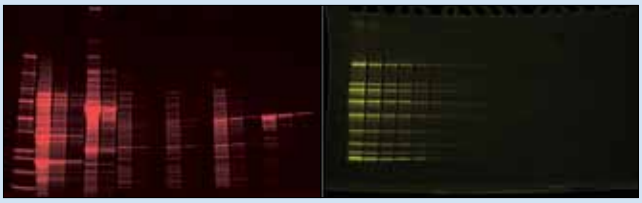
Verification and Quantitative Analysis

Protein Analysis

ChemiDoc XRS+ systems are often incorporated into sample preparation and sample quantitation workflows.



Protein gels stained with Coomassie Blue stain (left) and silver stain (right). Documentation of protein gels for lab notebooks or sample analysis, including protein purity and concentration assessment for differential protein expression studies or to monitor gene modulation products, is supported by the array of analysis tools in the ChemiDoc XRS+ system. The gel stained with silver stain shows salmon muscle, soybean, and rat brain extracts, protein mixtures, and *E. coli* extracts compared with Precision Plus Protein™ Unstained standards.



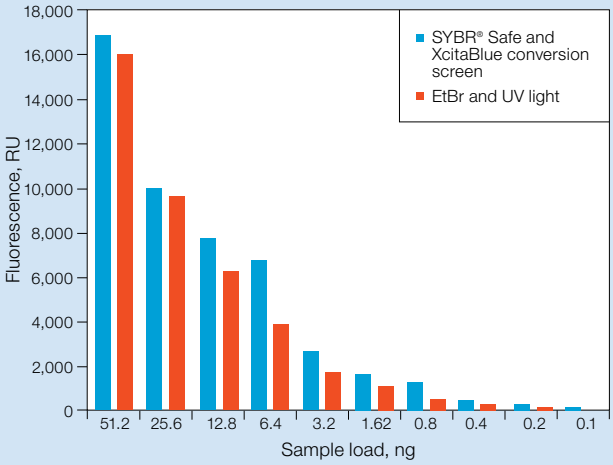
Protein gels fluorescence-stained with Oriole stain (left) and Flamingo fluorescent gel stain (right). Achieve higher levels of sensitivity with fluorescent stains to differentiate proteins with low expression. Resolve closely spaced spots or bands for protein profiling, quantitation, and characterization.

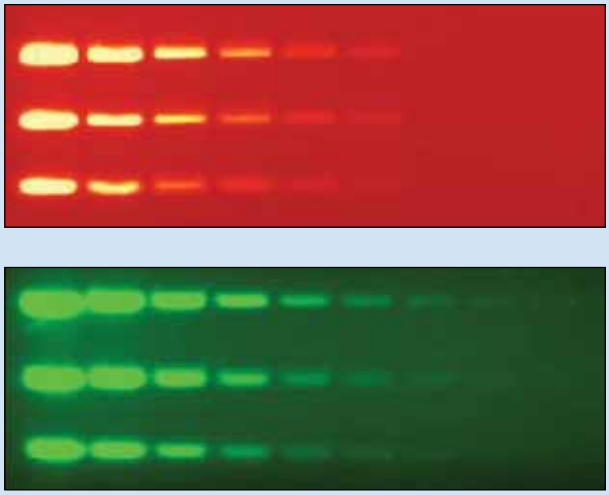
Molecular Biology

Gel electrophoresis remains an important tool for quantitative analysis of complex protein and nucleic acid samples. Applications include nucleic acid isolation or amplification for molecular cloning techniques, nucleic acid quality evaluation prior to quantitative PCR, gene silencing, gene modulation, and gene expression.

ChemiDoc XRS+ systems are suitable for laboratories engaged in RNAi analysis, molecular diagnostics, epigenetics, pharmacogenomics, and forensic testing of genomic DNA.

Ethidium Bromide and SYBR® Safe DNA Stain Detection





An alternative to UV illumination to better preserve DNA samples. Top, serial dilutions of EtBr-stained precision molecular mass ruler (Bio-Rad Laboratories, Inc.) on agarose gel imaged with UV light; **bottom**, serially diluted precision molecular mass ruler stained with SYBR® Safe stain on agarose gel imaged with XcitaBlue™ conversion screen. There is no loss in sensitivity when a combination of SYBR® Safe nucleic acid fluorescent stain and less harmful blue excitation is used instead of UV-excitable EtBr. The image of the gel stained with SYBR® Safe stain was taken using the XcitaBlue conversion screen and a filter for SYBR® Safe stain and GFP. Less harmful detection methods better preserve samples for downstream uses such as cloning.

Specifications

Automation Capabilities	
Workflow automated selection	Application driven; user selected or recalled by a protocol
Workflow automated execution	Controlled by a protocol via application specific setup for image area, illumination source, filter, analysis, and reporting
Workflow reproducibility	100% repeatability via recallable protocols; from image capture to quantitative analysis and reports
Autofocus (patent pending)	Precalibrated focus for any zoom setting or sample height
Image flat fielding*	Dynamic; precalibrated and optimized for every application
Autoexposure	2 user-defined modes (intense or faint bands)
Hardware Specifications	
Maximum sample size	28 x 36 cm
Maximum image area	25 x 26 cm
Excitation source	Trans-UV and epi-white are standard (302 nm included, with 254 and 365 nm available as options); optional trans-white, self-powered or conversion screen; optional XcitaBlue UV/blue conversion screen
Illumination control	5 modes (trans-UV, epi-white, and no illumination for chemiluminescence are standard); trans-white and XcitaBlue conversion screens are options
Detector	Supercooled CCD
Image resolution (H x V)	>4 megapixels
Pixel size (H x V)	6.45 x 6.45 µm
Cooling system	Peltier
Camera cooling temperature	–30°C controlled
Filter holder	3 positions (2 for filters, 1 without filter, for chemiluminescence)
Emission filters	1 included (standard), 3 optional
Dynamic range	>4.0 orders of magnitude
Pixel density (gray levels)	65,535
Instrument size (L x W x H)	36 x 60 x 96 cm
Instrument weight	32 kg
Operating Ranges	
Operating voltage	110/115/230 V AC nominal
Operating temperature	10–28°C (21°C recommended)
Operating humidity	<70% noncondensing

*U.S. patent 5,951,838.

Catalog #	Description
170-8265	Molecular Imager® ChemiDoc™ XRS+ System with Image Lab Software, PC or Mac, includes darkroom, UV transilluminator, epi-white illumination, camera, power supply, cables, Image Lab software
Accessories	
170-7950	White Light Transilluminator
170-8001	White Light Conversion Screen
170-8182	XcitaBlue Conversion Screen, includes view goggles; blue conversion screen for viewing SYBR® Green, SYBR® Safe, GFP, Flamingo, and other fluorescent gel stains
170-8183	XcitaBlue Conversion Screen and Filter, includes view goggles and SYBR® Safe filter (170-8075, 560DF50); blue conversion screen for viewing SYBR® Green, SYBR® Safe, and other fluorescent gel stains
170-8074	Filter 520DF30 62 mm, for SYBR® Green/GFP/SYBR® Gold/fluorescein
170-8075	Filter 560DF50 62 mm, for SYBR® Safe/Cy3/rhodamine
170-8076	Filter 630BP30 62 mm, for SYPRO Ruby/Texas Red
170-8077	Filter 480BP70 62 mm, for Hoechst/coumarin
170-8098	254 nm UV Lamps, pkg of 6
170-6887	365 nm UV Lamps, pkg of 6
170-8097	Standard 302 nm UV Lamps, pkg of 6
170-8089	Mitsubishi P93DW Printer
170-7581	Mitsubishi Thermal Printer Paper, 4 rolls
170-8184	Gel Alignment Templates, pkg of 3
Software	
170-9690*	Image Lab Software, PC or Mac, for automated image capture, optimization, and 1-D data analysis
170-8299	Image Lab Upgrade for ChemiDoc XRS+ System, includes Image Lab software, focus calibration target, flat fielding disk, installation guide, and user manual

* Included with the imaging system.

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